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FLOOD INSURANCE STUDY

TOWN OF WINDSOR, VERMONT
WINDSOR COUNTY

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JUNE 15, 1988

COMPLETED

Federal Emergency Management Agency

COMMUNITY NUMBER - 500159

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	4
	2.4 Flood Protection Measures	4
3.0	ENGINEERING METHODS	5
	3.1 Hydrologic Analyses	5
	3.2 Hydraulic Analyses	6
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	8
	4.1 Floodplain Boundaries	8
	4.2 Floodways	8
5.0	INSURANCE APPLICATION	9
6.0	FLOOD INSURANCE RATE MAP	14
7.0	OTHER STUDIES	14
8.0	LOCATION OF DATA	14
9.0	BIBLIOGRAPHY AND REFERENCES	15

TABLE OF CONTENTS - continued

Page

FIGURES

Figure 1 - Vicinity Map 3

Figure 2 - Floodway Schematic 12

TABLES

Table 1 - Summary of Discharges - Free Flowing Floods 6

Table 2 - Summary of Discharges - Ice Jam Floods 6

Table 3 - Floodway Data 10 - 11

EXHIBITS

Exhibit 1 - Flood Profiles
Connecticut River Panels 01P-03P 21-23
Mill Brook Panels 04P-08P 24-28

Exhibit 2 - Flood Insurance Rate Map Index and Street Index
Flood Insurance Rate Map

Exhibit 3 - Elevation Reference Marks

iii

FLOOD INSURANCE STUDY
TOWN OF WINDSOR, WINDSOR COUNTY, VERMONT

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Study/Flood Insurance Rate Map for the Town of Windsor, Windsor County, Vermont. This information will be used by the Town of Windsor to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study represent a revision of the original analyses prepared by the New England District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency IAA-H-2-73, Project Order No. 4. The hydrologic and hydraulic analyses for this updated study was prepared by Dufresne-Henry, Inc., for FEMA, under Contract No. EMW-84-C-1597. This work was completed in May 1986.

1.3 Coordination

In April 1984, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the town, and Dufresne-Henry, Inc. (the study contractor), to identify the streams to be studied by detailed methods. The Town of Windsor, the COE, the Vermont Agency of Transportation, and the Vermont Department of Water Resources provided information pertinent to this study. On April 15, 1987, the results of the study were reviewed at a final CCO meeting held with representatives of FEMA, the town, the study contractor, and the Vermont Department of Water Resources.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Windsor, Windsor County, Vermont. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods: the Connecticut River, for its entire length affecting the community; and Mill Brook, from its confluence with the Connecticut River to approximately 0.8 mile upstream of Interstate Route 91. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through May 1991.

The remaining portions of Mill Brook were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Town of Windsor.

2.2 Community Description

The Town of Windsor is located in southeastern Windsor County on Vermont's eastern border, approximately 12 miles south of White River Junction and 31 miles east of the City of Rutland. It is bordered by the Town of Hartland to the north; the Town of West Windsor to the west; the Town of Weathersfield to the south; and the Town of Cornish, Vermont, to the east. Windsor has the distinction of having been the first capital when the State of Vermont was formed in 1777. The total land area of the town is 19.6 square miles. In 1980, the population of the town was 4,084, a 2 percent decrease from the 1970 population of 4,158 (References 1, 2, and 3).

The Connecticut River originates in the mountains of New Hampshire and flows south, forming the Vermont-New Hampshire border. The Connecticut River has a drainage area of approximately 4,700 square miles at the Cornish covered bridge. Mill Brook rises in the Town of Reading and flows east through West Windsor to Windsor where it has a drainage area of 42 square miles at its mouth.

The climate in Windsor is continental with warm summers and cold winters. Average annual precipitation is approximately 39 inches, and average annual snowfall is approximately 80 inches (Reference 4). Precipitation is evenly distributed throughout the year.

The topography of the community is generally mountainous except for the floodplains of the Connecticut River. The soils along the

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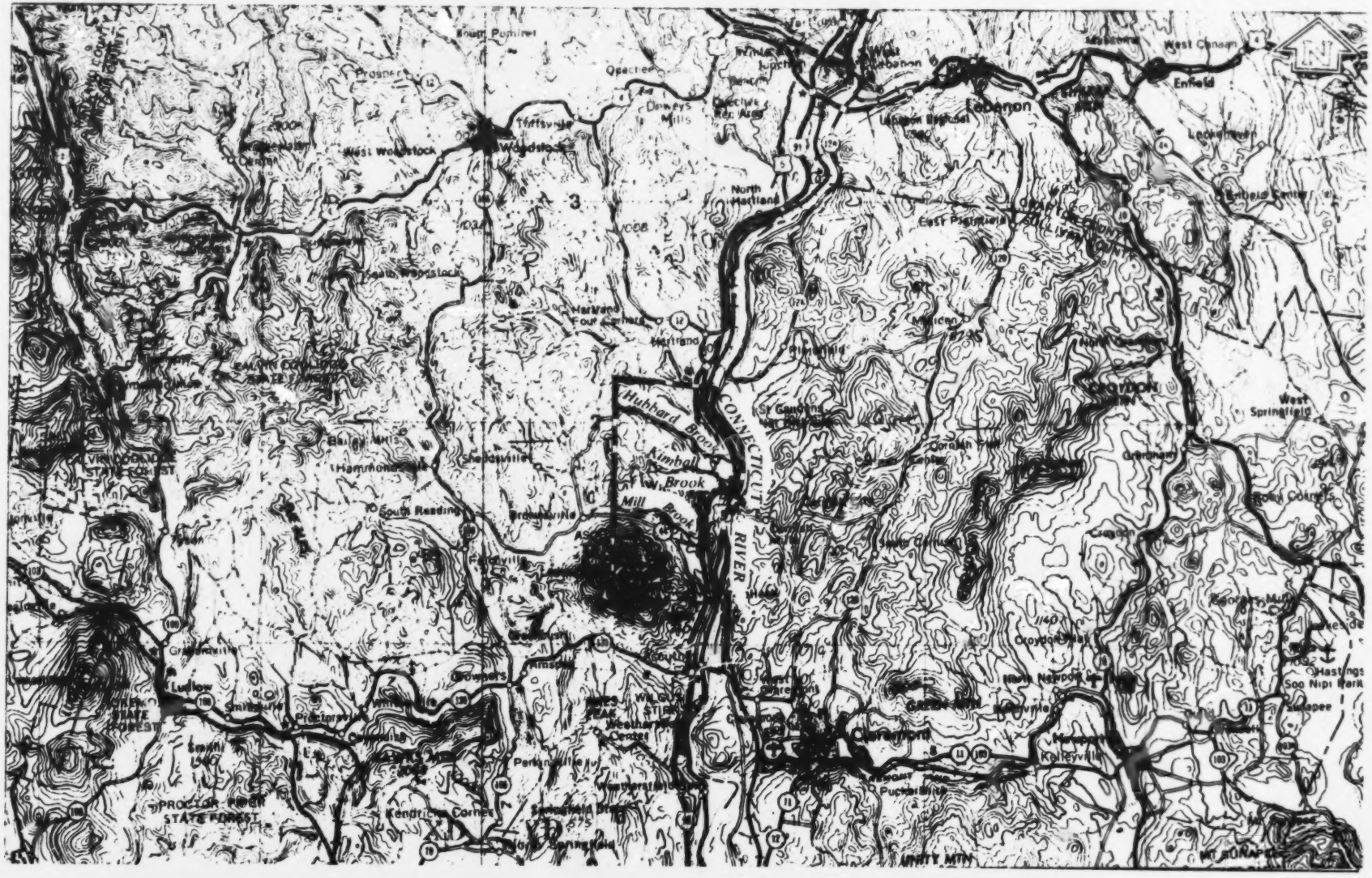


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WINDSOR, VT

(WINDSOR CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

Connecticut River and Mill Brook are deep, well drained soils typical of old lake plains. Those along the Connecticut River are silty and sandy, while those along Mill Brook are sandy and gravelly. Upland soils are generally shallow and may have hardpan or bedrock within 3 feet, typical of soils formed in glacial till (Reference 5).

2.3 Principal Flood Problems

Significant floods have occurred in Windsor in 1866, 1896, 1913, 1927, 1936, 1938, 1973, 1976, 1977, and 1979. The November 1972 flood was the largest of record with a discharge of 136,000 cubic feet per second (cfs) recorded at the White River Junction U. S. Geological Survey (USGS) gage. An account of the 1927 flood describes the Connecticut River flooding of 5 feet in the Warsaw district; inundation of over 100 homes; and 3 feet of flooding at the National Acme Company, Windsor's principal industry at that time (Reference 6). Mill Brook also caused substantial flood damage, undermining a 72 unit apartment house then owned by the Namco Company.

The March 1936 flood was lower in discharge than the 1927 flood, but it accompanied the spring breakup of ice and caused flooding to elevations only slightly lower than experienced in 1927. In more recent years, the only floods to inundate developed areas in Windsor were associated with ice jams that occurred in March 1977 and March 1979. During both of these events highways and structures on both sides of the Connecticut River were flooded with up to several feet of water. New England Power Company was maintaining a staff gage on the covered bridge during both of these events.

Although the maximum stage of the 1977 ice jam flooded Bridge Street preventing access to the gage, available data indicate that the 1936 flood was probably approximately 3 feet higher at the bridge. The 1979 jam was less severe, approximately 7.5 feet below the 1936 stage at the bridge, but it was still high enough to cover U. S. Route 5 (North Main Street) north of the village.

2.4 Flood Protection Measures

There are no flood control structures located in Windsor. Two COE dams operated to desynchronize peak flows from the Connecticut River tributaries are located upstream of Windsor. Union Village Dam is located on the Ompompanoosuc River 20 miles north of Windsor, and North Hartland Dam is located on the Ottauquechee River approximately 6 miles north of Windsor. Together these reservoirs can be operated to reduce natural flood peaks on the Connecticut River in Windsor by approximately 15 percent.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The free-flowing discharges for the Connecticut River and Mill Brook were obtained from the previous Flood Insurance Study for the Town of Windsor (Reference 7). The free-flowing discharges for the Connecticut River were based on data developed by the COE (Reference 8). The free-flowing discharges for Mill Brook were based on a regional analysis of the drainage area-peak discharge relationship from statistically determined peak discharges for 15 geographically similar streams gaged by the USGS with a total of 344 years of record.

A summary of the drainage area-peak discharge relationships for the free-flowing floods of the Connecticut River and Mill Brook is shown in Table 1, "Summary of Discharges -Free-Flowing Floods."

Winter discharges used for the ice jam analysis on the Connecticut River were chosen based on discharges that were gaged at the White River Junction USGS gage and other tributary gages during ice jam floods in 1936, 1977, and 1979. It was assumed that the 1936, 1977, and 1979 events have recurrence intervals of approximately 100, 50, and 10 years, respectively.

TABLE 1 - SUMMARY OF DISCHARGES - FREE-FLOWING FLOODS

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CONNECTICUT RIVER At downstream corporate limits	4,700	70,500	100,700	117,500	159,400
MILL BROOK At confluence with Connecticut River	42	3,300	4,980	5,860	8,125

A summary of the drainage area-peak discharge relationships for the ice jam analysis of the Connecticut River is shown in Table 2, "Summary of Discharges - Ice Jam Floods."

TABLE 2 - SUMMARY OF DISCHARGES - ICE JAM FLOODS

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CONNECTICUT RIVER At downstream corporate limits	4,700	40,000	50,000	60,000	70,000

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the Connecticut River were taken from the Flood Insurance Study for the Town of Cornish and were obtained by photogrammetric methods (Reference 9); below water-surface elevations were field surveyed for that study. Cross sections for Mill Brook up to Mill Pond were obtained from the previous Flood Insurance Study for the Town of Windsor (Reference 7). Upstream of Mill Pond, cross sections were based on field surveys taken in August 1985.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 10). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Connecticut River were taken from the Flood Insurance Study for the Town of Weathersfield (Reference 11). For Mill Book, the starting water-surface elevations were computed by the slope/area method.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment based on field observations of the stream and floodplain area. These factors were compared with Water-Supply Paper 1849 and Hydraulic Design Series No. 4 (References 12 and 13). Channel "n" values for the Connecticut River ranged from 0.032 to 0.035, and the overbank "n" values ranged from 0.060 to 0.250. For Mill Brook, the channel "n" values ranged from 0.025 to 0.040, and the overbank "n" values ranged from 0.035 to 0.100.

Ice jams were analyzed based on experienced flood elevations associated with ice jam events at several locations along the Connecticut River. The primary source of data was the record of river gage readings at the Cornish covered bridge and ice conditions along the river maintained by New England Power. Ice thickness and location was then used with the winter discharges for the selected recurrence intervals to calibrate the ice jam model to historical stages at the bridge. Data on ice jams at other locations along the Connecticut River near Windsor are sparse; however, since this study was done at the same time as the Flood Insurance Studies for the Towns of Hartland and Hartford, information available in those communities was used in this study (References 14 and 15). In particular, tree scars at Sumner Falls in Hartland provided a clear record of repeated ice jams and associated stages. High-water marks recorded for the 1936 flood at several locations provided additional points for calibration.

Free-flowing and ice jam flood elevations for each recurrence interval at each cross section were used to determine combined stage frequency curves along the Connecticut River.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries for the Connecticut River were interpolated using aerial photographs from the Flood Insurance Study for the Town of Cornish (Reference 9). For Mill Brook, the boundaries were interpolated using topographic maps at a scale of 1:2,400 with a contour interval of 5 feet (Reference 16).

For the stream studied by approximate methods, the 100-year flood boundaries were delineated using the previous Flood Insurance Study for the Town of Windsor (Reference 7).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the stream studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment

itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 3). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. The floodway computations for the Connecticut River do not consider the effects of ice jams. Portions of the floodway widths for the Connecticut River extend beyond the corporate limits.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 3 for certain downstream cross sections of Mill Brook are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Connecticut River								
A	0[1]	607[3]	18,592	6.3	322.2[4]	320.0	320.0	0.0
B	5,385[1]	620[3]	19,762	5.9	332.0[4]	321.3	321.3	0.0
C	11,085[1]	540[3]	16,420	7.2	324.1[4]	322.1	322.3	0.2
D	14,535[1]	800[3]	23,804	4.9	325.0[4]	323.0	323.4	0.4
E	14,745[1]	720[3]	20,813	5.6	325.2[4]	322.9	323.3	0.4
F	15,420[1]	589[3]	17,112	6.9	325.2[4]	323.0	323.4	0.4
G	15,636[1]	818[3]	25,725	4.6	325.9[4]	324.3	324.6	0.3
H	17,081[1]	589[3]	17,543	6.7	325.9[4]	324.4	324.7	0.3
I	17,405[1]	547[3]	17,866	6.6	326.8[4]	324.6	325.4	0.8
J	24,005[1]	679[3]	20,650	5.7	327.2[4]	326.2	326.8	0.6
K	29,005[1]	740[3]	19,279	6.1	328.0[4]	327.1	327.9	0.8
L	30,305[1]	607[3]	17,785	6.6	328.1[4]	327.2	328.2	1.0
M	32,155[1]	567[3]	15,072	7.8	328.1[4]	327.2	328.2	1.0
N	35,905[1]	624[3]	20,621	5.7	330.2[4]	329.3	330.1	0.8
Mill Brook								
A	406[2]	89	549	10.7	325.9	302.6[5]	302.6	0.0
B	675[2]	132	790	7.4	325.9	304.4[5]	304.4	0.0
C	860[2]	153	1,425	4.1	325.9	310.1[5]	310.1	0.0
D	1,100[2]	91	457	12.8	325.9	314.4[5]	314.4	0.0
E	1,250[2]	88	833	7.0	328.9	328.9	328.9	0.0
F	1,305[2]	122	1,080	5.4	329.4	329.4	329.4	0.0
G	1,395[2]	95	1,352	4.3	329.6	329.6	329.6	0.0

[1]Feet above corporate limits

[2]Feet above confluence with Connecticut River

[3]This width extends beyond corporate limits

[4]Elevation computed considering ice jam effects

[5]Elevation computed without consideration of backwater effects from Connecticut River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WINDSOR, VT

(WINDSOR CO.)

FLOODWAY DATA

CONNECTICUT RIVER - MILL BROOK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Mill Brook (continued)								
H	1,500	140	1,445	4.1	344.0	344.0	344.0	0.0
I	1,802	77	655	9.0	344.0	344.0	344.0	0.0
J	1,979	93	1,021	5.7	345.2	345.2	345.2	0.0
K	2,463	80	802	7.3	345.7	345.7	345.7	0.0
L	3,199	98	764	7.7	345.9	345.9	346.0	0.1
M	3,297	105	700	8.4	345.9	345.9	345.9	0.0
N	3,424	122	943	6.1	346.1	346.1	346.8	0.7
O	4,358	190	962	6.1	346.9	346.9	347.5	0.6
P	4,682	63	527	11.1	347.1	347.1	347.5	0.4
Q	4,870	85	737	7.9	348.6	348.6	349.6	1.0
R	5,080	98	961	6.1	350.8	350.8	350.8	0.0
S	5,412	64	431	13.6	350.8	350.8	350.8	0.0
T	5,550	130	844	6.9	352.1	352.1	352.9	0.8
U	11,550	301	981	6.2	388.0	388.0	388.8	0.8
V	13,170	172	1,216	5.0	395.3	395.3	396.1	0.8
W	14,580	138	1,009	6.0	398.1	398.1	399.0	0.9
X	16,205	102	582	10.4	403.2	403.2	403.6	0.4
Y	16,340	73	638	9.5	407.8	407.8	407.8	0.0
Z	18,170	75	454	13.3	419.6	419.6	419.6	0.0
AA	19,995	78	903	6.7	428.1	428.1	429.1	1.0

[1]Feet above confluence with Connecticut River

TABLE 3

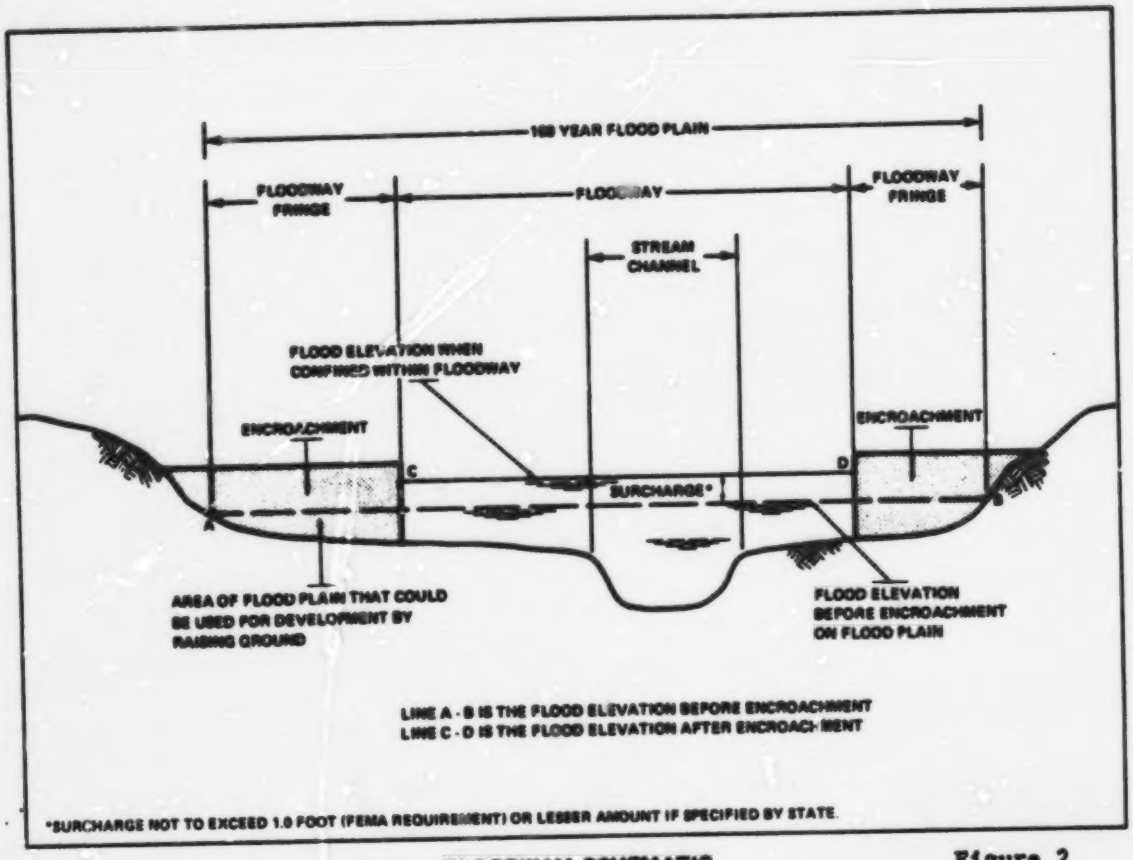
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WINDSOR, VT

(WINDSOR CO.)

FLOODWAY DATA

MILL BROOK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies have been published for the Town of Cornish, New Hampshire; and the Town of Weathersfield, Vermont (References 9 and 11). The results of this study are not in agreement with the results of the Cornish study on the Connecticut River since this study incorporates revisions to the ice jam analysis that was necessary to obtain better agreement with historical data and current FEMA criteria. The Weathersfield study does not match this study on the Connecticut River since ice jam effects were not considered in the Weathersfield study.

A Flood Insurance Study for the Town of Hartland is currently being prepared (Reference 14). The results of that study will be in complete agreement with the results of this study.

Due to its more up-to-date analyses, this study supersedes the previous Flood Insurance Study for the Town of Windsor (Reference 7).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

9.0 BIBLIOGRAPHY AND REFERENCES

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13. U. S. Department of Commerce, Bureau of Public Roads, Hydraulic Design Series No. 4, Design of Roadside Drainage Channels, Washington, D. C., U. S. Government Printing Office, May 1965.

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EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	02	405.3	Standard USC&GS disk stamped X 53 1978, 1 foot west of witness post, 1.5 feet northeast of power pole No. 19, 6, 141 with two transformers, 22.5 feet southeast of centerline of U. S. Route 5 and State Route 12, 64 feet northwest of southwest corner of barn, approximately 3.05 miles north from Windsor post office.
RM 2	02	325.5	Standard USC&GS disk stamped V 53 1978, 1 foot west of power pole 6, 65, 243, 1 foot east of witness post, 26 feet east of centerline of U. S. Route 5 and State Route 12, 40.8 feet west of west rail of Central Vermont Railroad, approximately 1.05 miles north of Windsor post office.
RM 3	04	319.06	State monument at southeast corner of U. S. Route 5 and State Route 12 bridge over Hubbard Brook, approximately 1,200 feet south of intersection of U. S. Route 5 and State Route 12, and Juniper Hill Road.
RM 4	04	331.21	USC&GS Monument 25 in east foundation wall of Central Vermont Railroad station, approximately 450 feet east of intersection of State Street and Main Street.

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 5	04	358.4	Standard USC&GS disk stamped T53 1978, set in bedrock 3 feet above highway, 1 foot northwest of witness post, 24.5 feet northwest of centerline of U. S. Route 5 and State Route 12, 22.5 feet northeast of highway marker sign 0050-1423-0220, 26.5 feet southeast of center of small culvert, approximately 100 feet west of power pole No. 41, approximately 1.55 miles south from Windsor post office.
RM 6	04	354.19	USC&GS Monument 354 in west foundation wall of Methodist Church, approximately 400 feet northeast of intersection of U. S. Route 5 and State Route 12, and Bridge Street.
RM 7	04	346.23	State bench mark 14, box cut on northwest corner of concrete wall of U. S. Route 5 and State Route 12 bridge over Mill Brook.
RM 8	04	360.2	Standard USC&GS disk stamped U 53 1978, 1 foot east of witness post, 1 foot east of cable guard rail, 13 feet south of State Highway Ends sign, 22 feet northeast of center of Lowell Street, 27 feet southeast of centerline of U. S. Route 5 and State Route 12, 31 feet southwest of southwest corner of house No. 203, approximately 0.5 mile south of Windsor post office.

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 9	04	349.24	State monument at northeast corner of Union Street bridge over Mill Brook, approximately 500 feet west of U. S. Route 5 and State Route 12.
RM 10	04	356.35	State monument at southwest corner of Union Street bridge over Mill Brook, approximately 1,800 feet west of U. S. Route 5 and State Route 12.
RM 11	04	390.19	Chiseled square at west end of Mill Pond Dam above National Historic Site sign.
RM 12	04	453.77	Drill hole on top of monument in front of Vermont National Guard Armory on State Route 44 (Ascutney Street).
RM 13	04	473.98	8-inch spike in power pole 32/13 along Brook Road where pavement turns to gravel.
RM 14	06	417.23	Standard survey disk stamped 91017 in northwest corner of State Route 44 bridge over Mill Brook, just west of Interstate Route 91.
RM 15	06	350.3	Standard USC&GS disk stamped S53 1978, 1 foot northwest of power pole No. 337-69, 1 foot southeast of fire hydrant, 25.5 feet southeast of centerline of U. S. Route 5 and State Route 12, approximately 2.4 miles south of Windsor post office.

EXHIBIT 3 - ELEVATION REFERENCE MARKS - continued

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 16	06	358.4	Standard USC&GS disk stamped T53 1978, 1.5 feet south of power pole No. 365-1192A, 7 feet north of metal pole supporting U. S. Route 5 sign, 30 feet east of centerline of U. S. Route 5 and State Route 12, approximately 0.05 mile south of Sugarbush Florist building, approximately 1.95 miles north of Ascutney post office.

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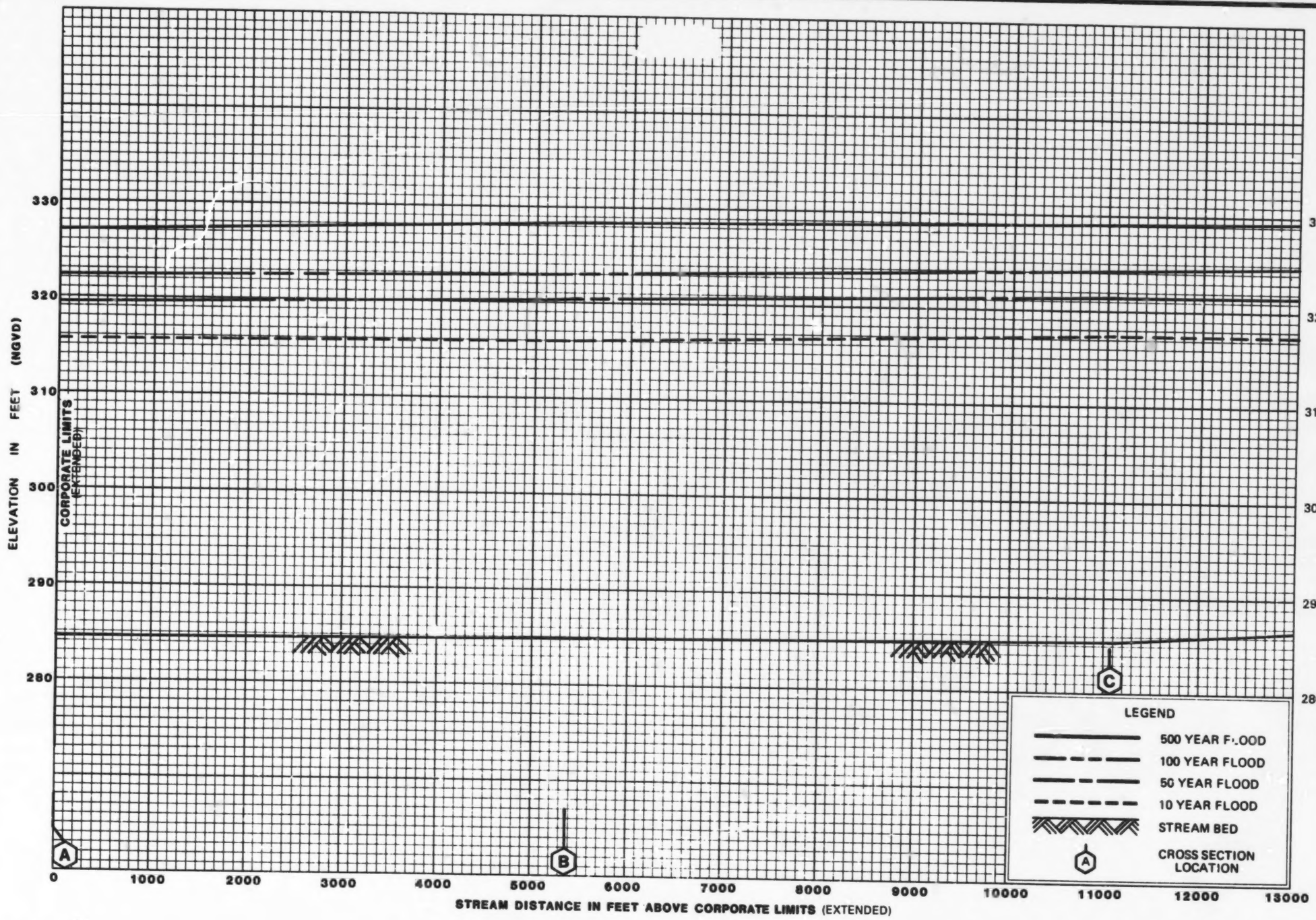

FLOOD PROFILES

CONNECTICUT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WINDSOR, VT
(WINDSOR COUNTY)

01P

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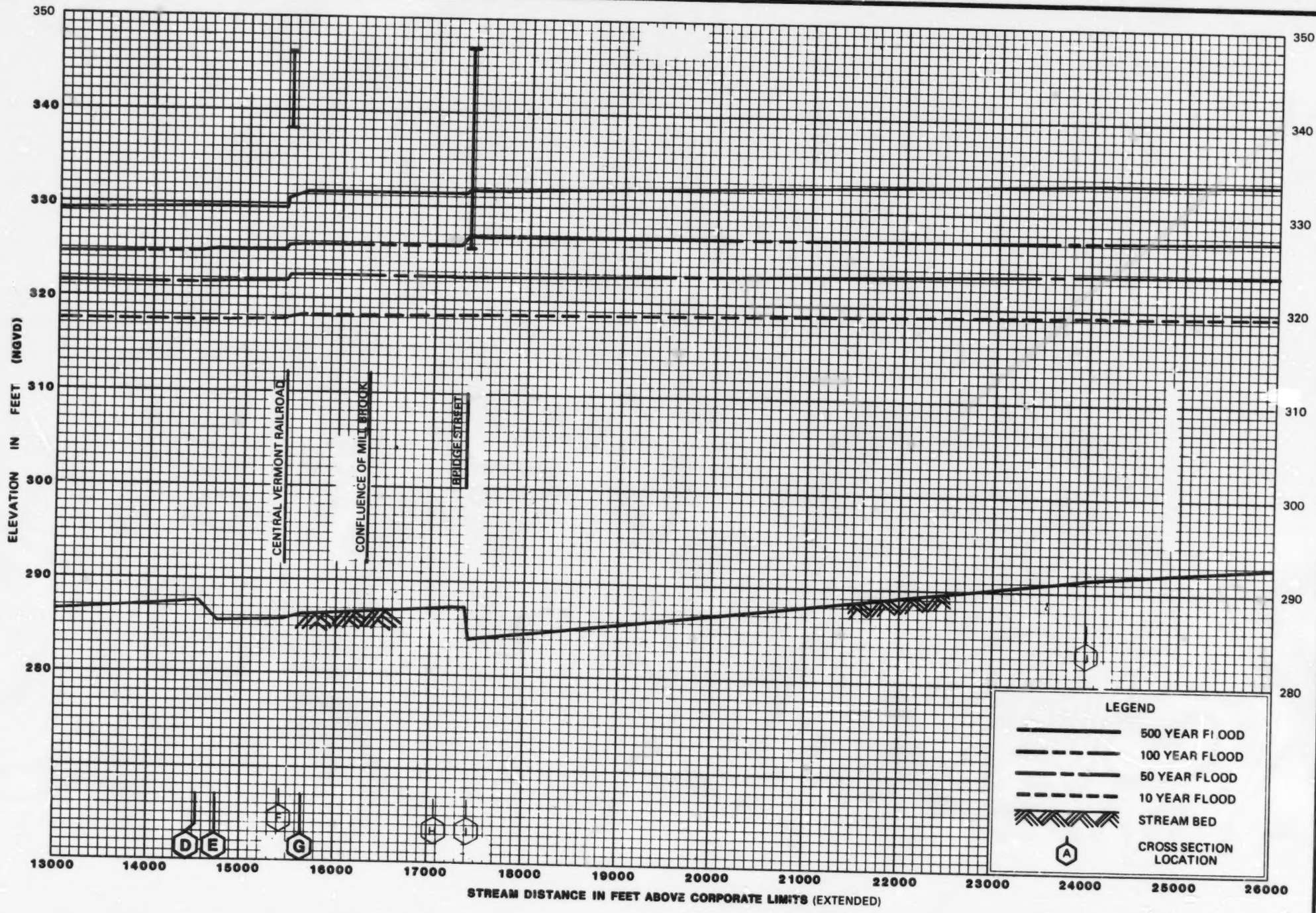

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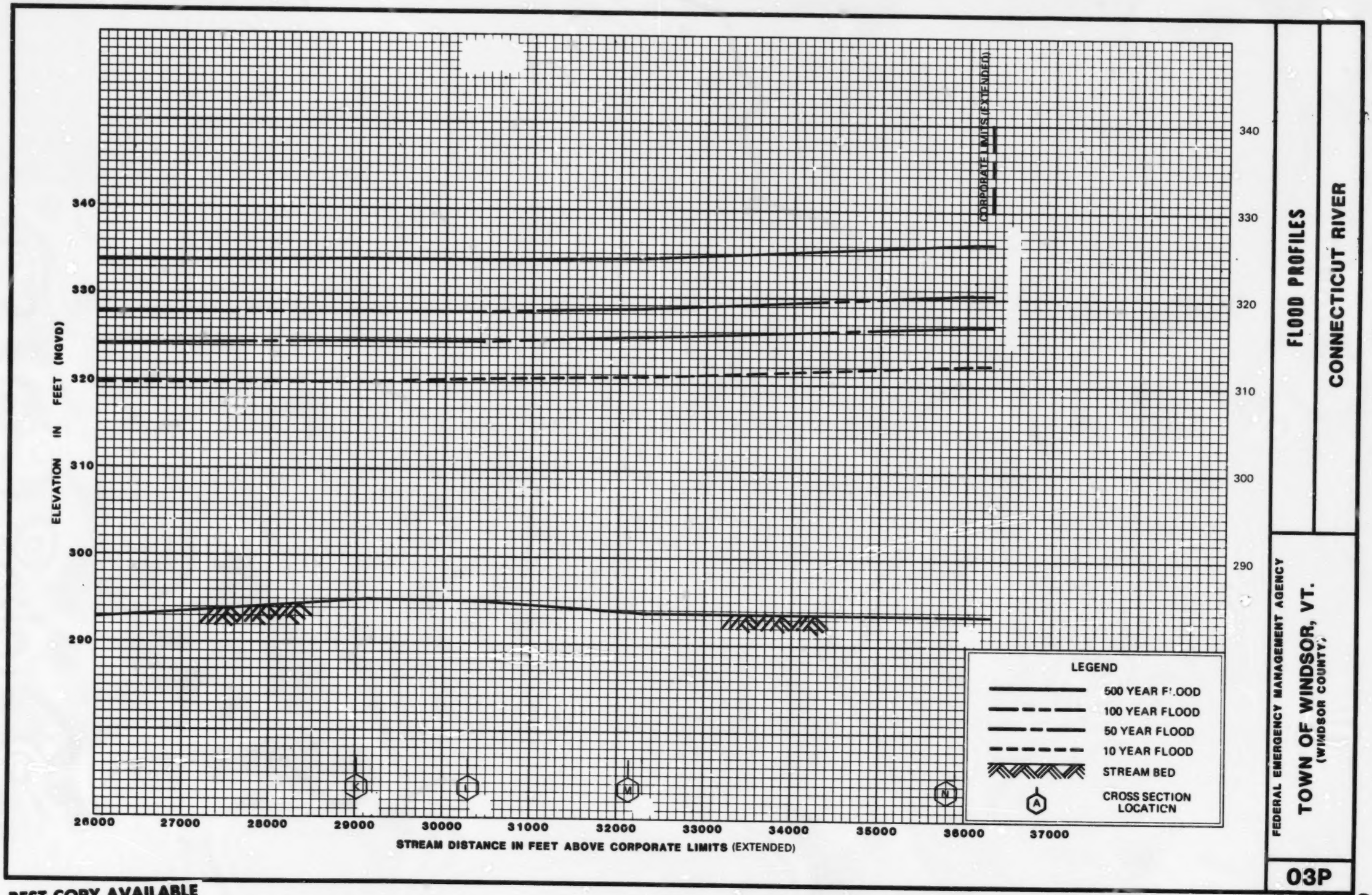

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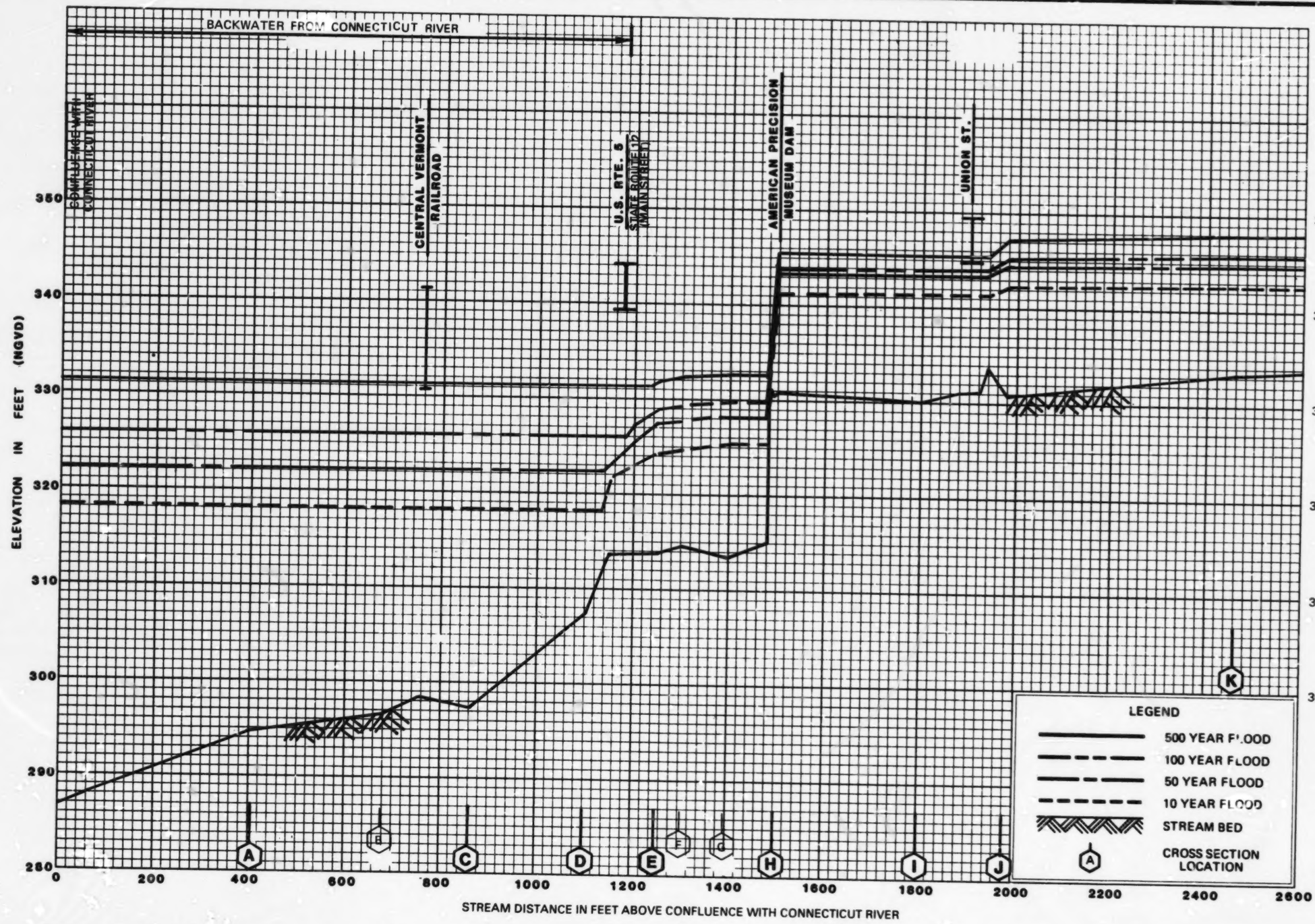

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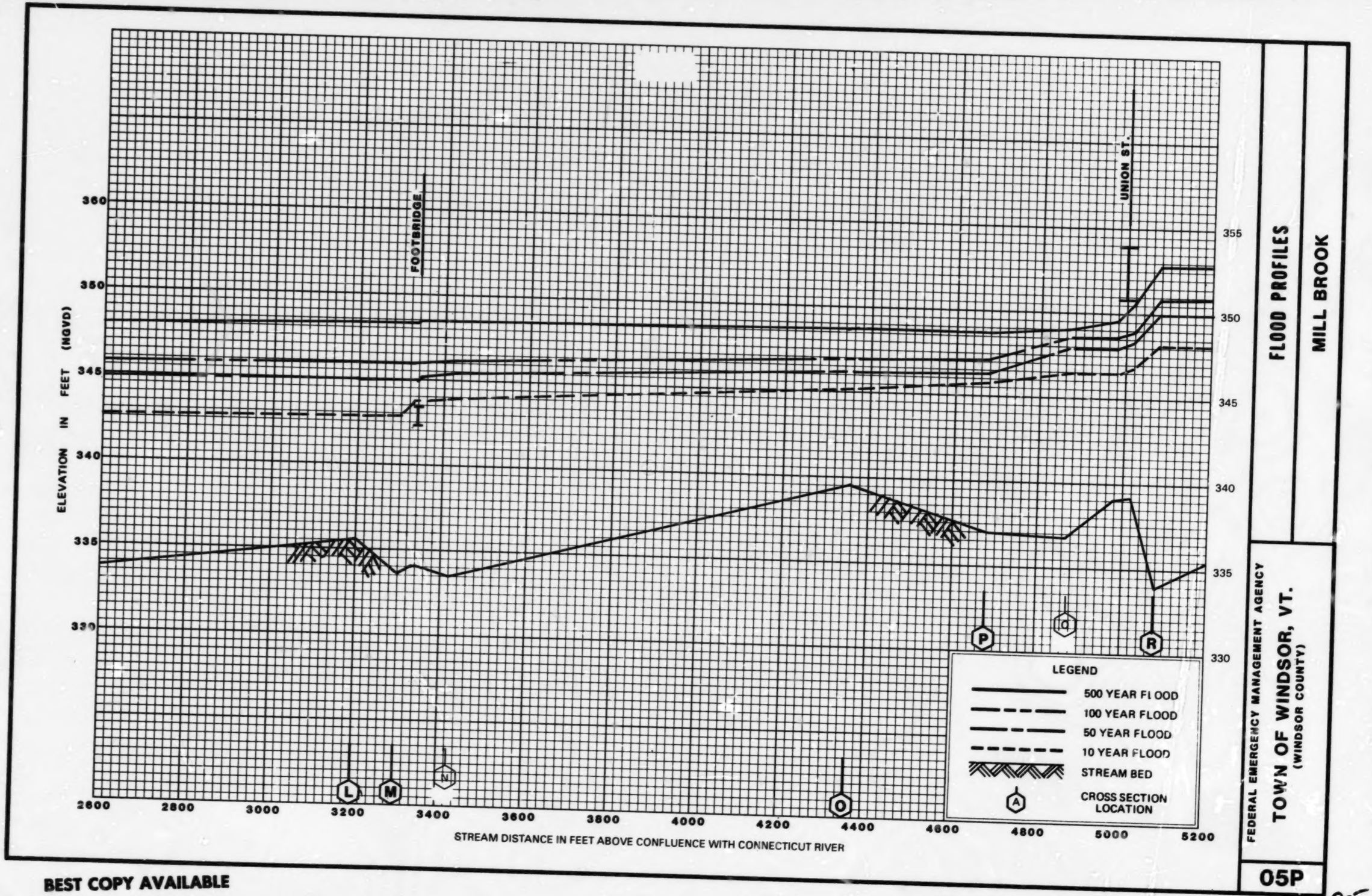

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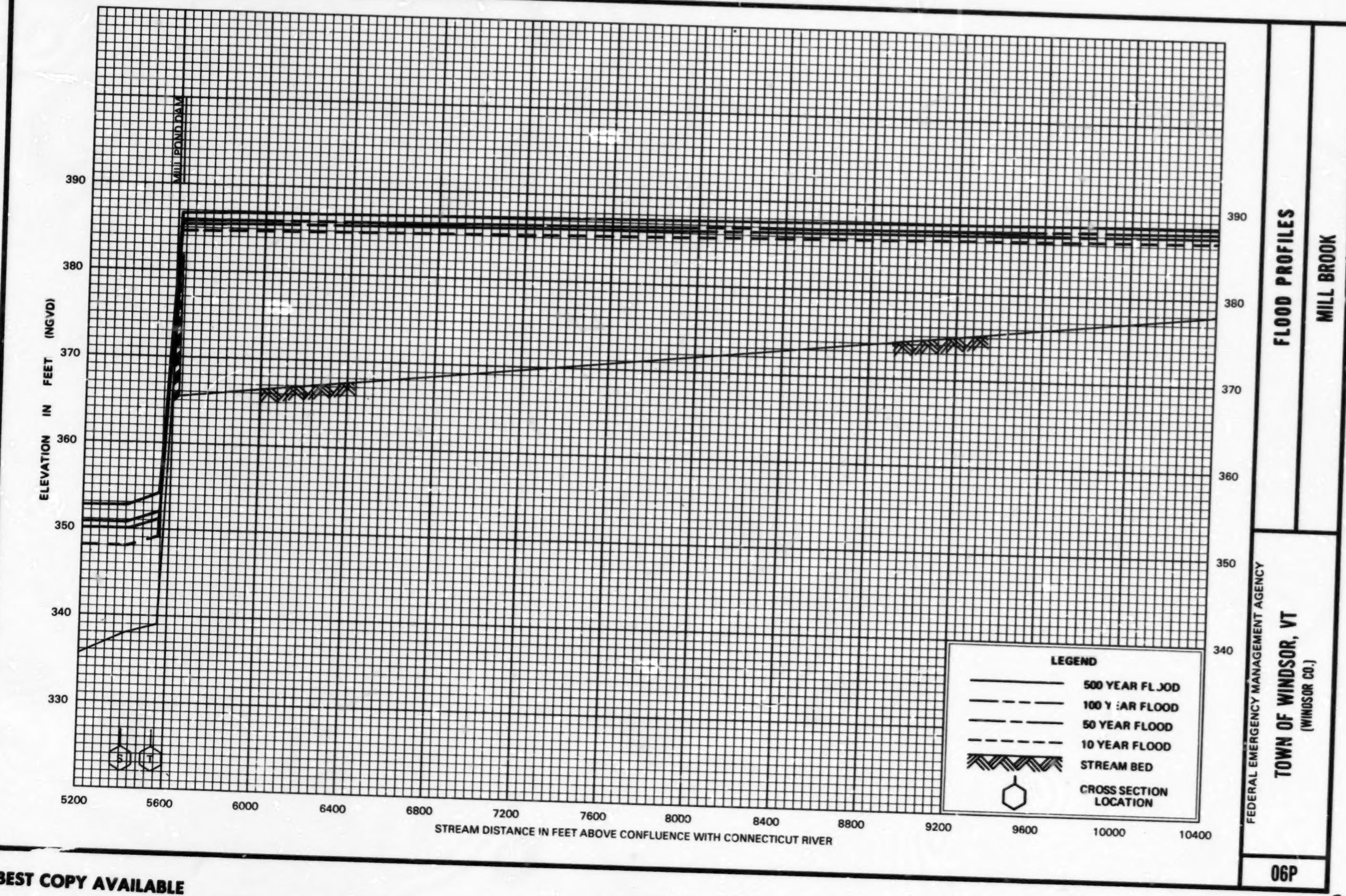

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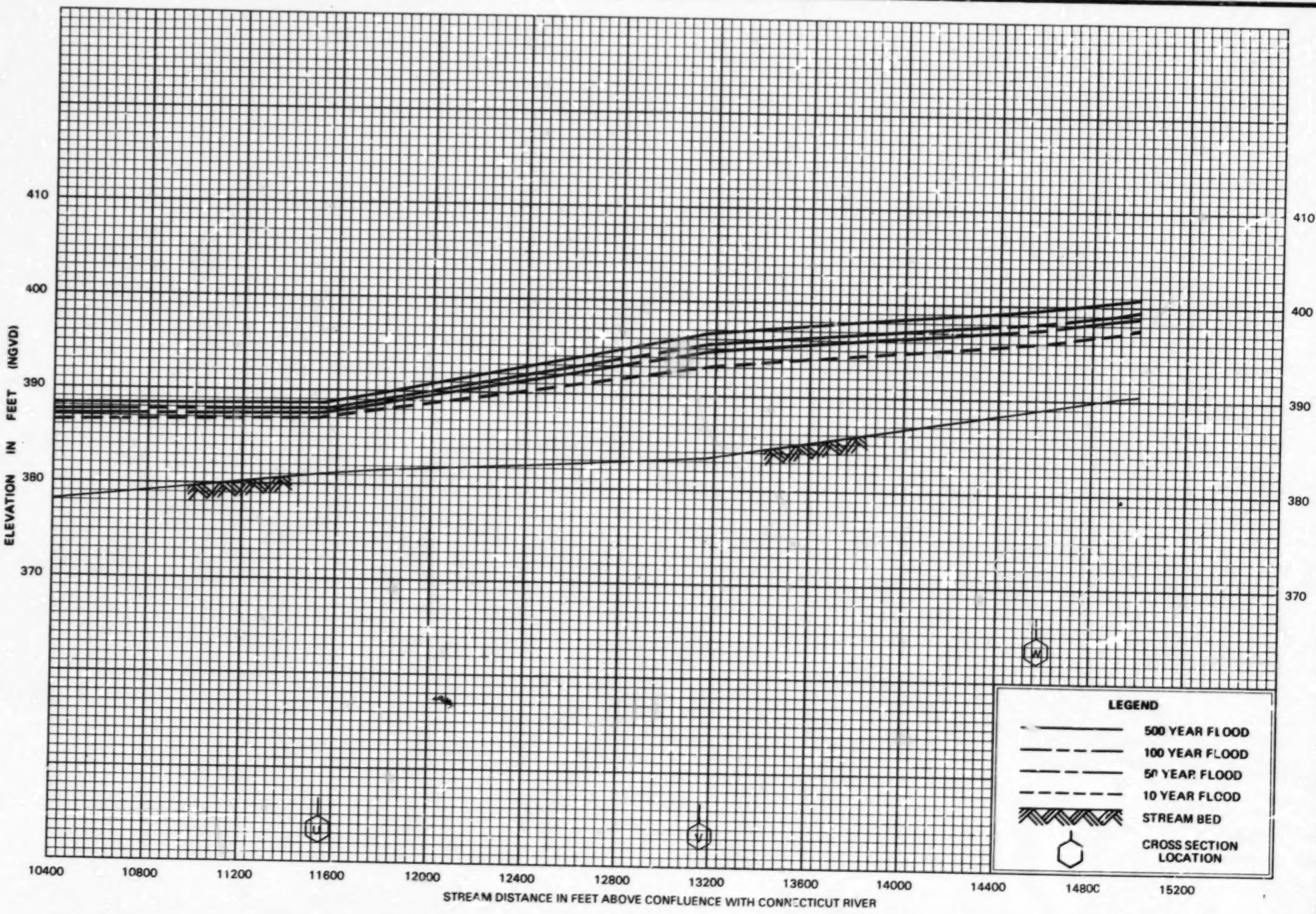

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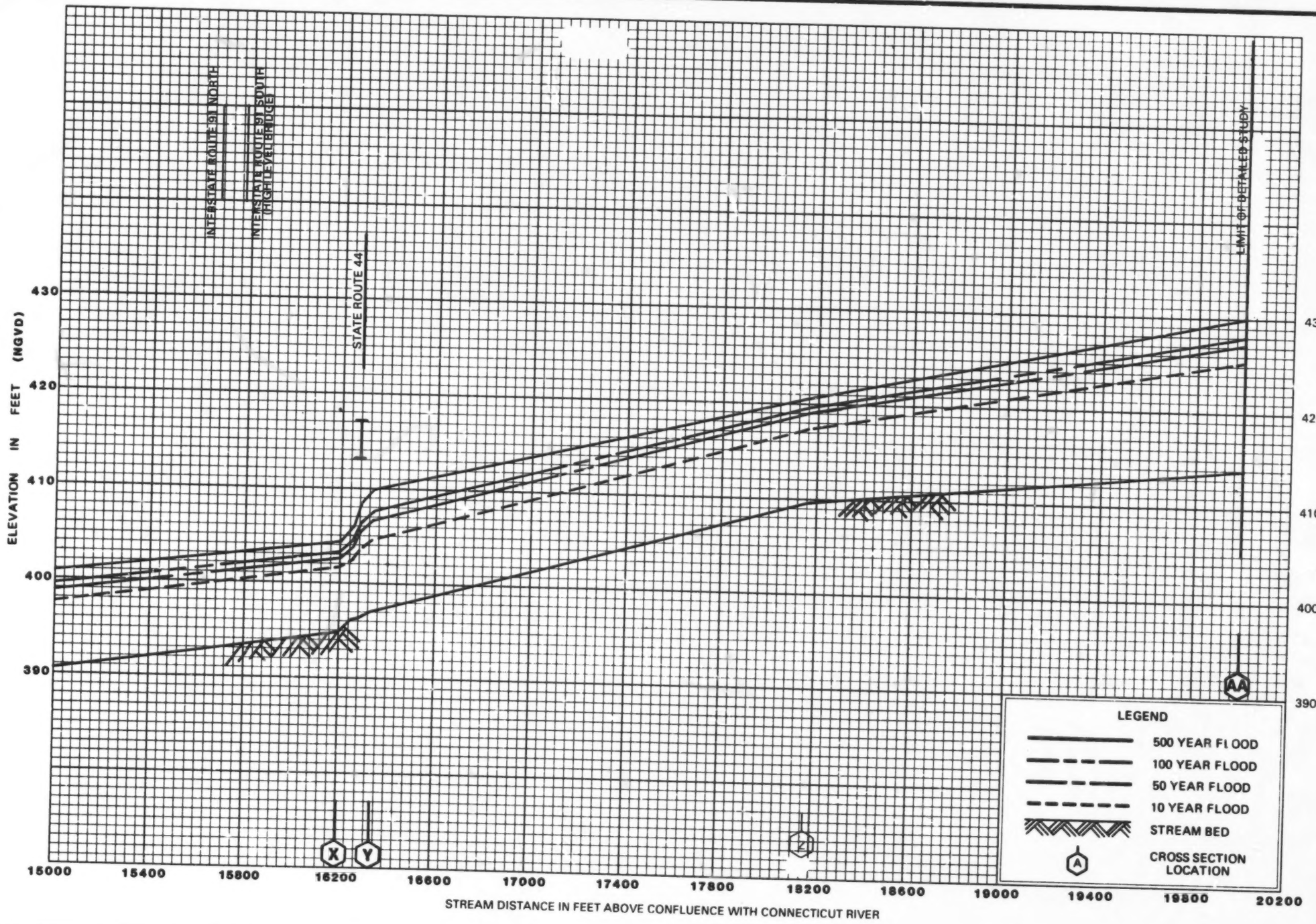

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